STUDIES IN LIFE-HISTORIES OF AUSTRALIAN DIPTERA BRACHYCERA.

Part i. Stratiomyiidae.

No. 2. Further experiments in the rearing of *Metoponia rubriceps*.

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(Eight Text-figures.)

Attempts to rear the larval *Metoponia rubriceps* from the egg, which were made last year and described in the first paper of this series, were continued throughout the Spring and Summer, and have at last met with a considerable measure of success. It has been found possible to breed from flies reared from the larva in captivity, and the cycle, from larva to the larva of the next generation, has been obtained. Unfortunately, the bred larvae all perished at an early stage, so that the cycle is not yet quite complete, and the length of time occupied in the larval state has still to be determined.

The larvae used in the experiments were those collected in May and August of 1920. Early in the following Spring, many began to show signs of the immobility which marks the onset of pupation, and, as this occurred, the pupating larvae were put into separate vessels. Common half-pint glass preserving jars were found most suitable for the purpose, filled to a depth of an inch or two with the sandy soil in which the larvae normally live, and planted with a little couch grass, having stems long enough to afford a resting place for the flies as they emerged. The soil was kept slightly damp, and the jars, loosely covered with metal screw tops, were kept on a window ledge where they were exposed to direct sunlight for several hours after sunrise. Each jar contained several pupae, judged by their sizes to be of the two sexes.

Under these conditions, a good proportion of the pupae completed their development, and imagines appeared over a much longer period than had been observed in the field. The earliest, a male, emerged on 11th October, while others were obtained as late as December. One pupa noticed to be immobile on 12th December, was dissected on 19th December, and found to be still in a very early stage of pupation.

During this Spring, very few of the adult flies were caught in the field. A long period of drought had evidently proved unfavourable for their development. The lawn at the Australian Museum, from which the larvae had been obtained, had become very dry, and the earth had caked hard, when it was searched for larvae and pupae on 4th November. Though a good number

of living larvae were found, full pupal cases were very scarce, and the majority of those found contained dead and decayed pupae.

Under these circumstances it was impossible to carry out breeding experiments with flies obtained in the adult stage, and it became necessary to rely on those bred out in the laboratory. Unfortunately, in most cases they emerged singly, and at such long intervals that flies of both sexes were rarely alive at the same time. However, on the morning of 11th November, two flies, a male and a female, emerged in the one jar, within a short time of one another. They immediately crawled up the grass stems, and remained there, quite motionless, for the first two days. On the third morning, 13th November, the intense light of a hot day seemed to have roused them to activity, for they were found during the morning, engaged in a "courting" dance in the sunshine, following one another in rapid flight up and down the grass stems, and sides of the vessel. Copulation was not observed, but at seven o'clock on the following morning, 14th November, a small white cluster of eggs was found deposited in a single irregular clump, against the side of the jar, on a level with the surface of the soil. Next day the male died, and the female lived only one day longer.

In view of the previous failures with eggs which had been handled, it was judged safer to leave these eggs entirely undisturbed, and trust to the very imperfect observation afforded through the glass of the jar, to determine whether any changes occurred in them. The lid was kept on the jar, and a slight amount of moisture retained in the soil.

At the end of the first week, the eggs appeared to darken in colour, and by 27th November, the fourteenth day after deposition, they had become amber coloured. No further observation was made until 30th November, when the egg clump was not visible at all. The soil, therefore, was carefully turned out, in small quantities, on to glass Petri dishes, and examined under the microscope. The search was rewarded by the finding of newly hatched, living larvae, no bigger than the particles of soil among which they were crawling, and of eggs which contained unhatched, but well-developed larvae. The latter were picked out with a camels-hair brush, and kept, for further observation, on a small quantity of damp soil in a small crystal dish. However, either they were already dead, or the change of environment proved fatal, for no further development took place in them, and after a few days they were all decayed and covered with fungus.

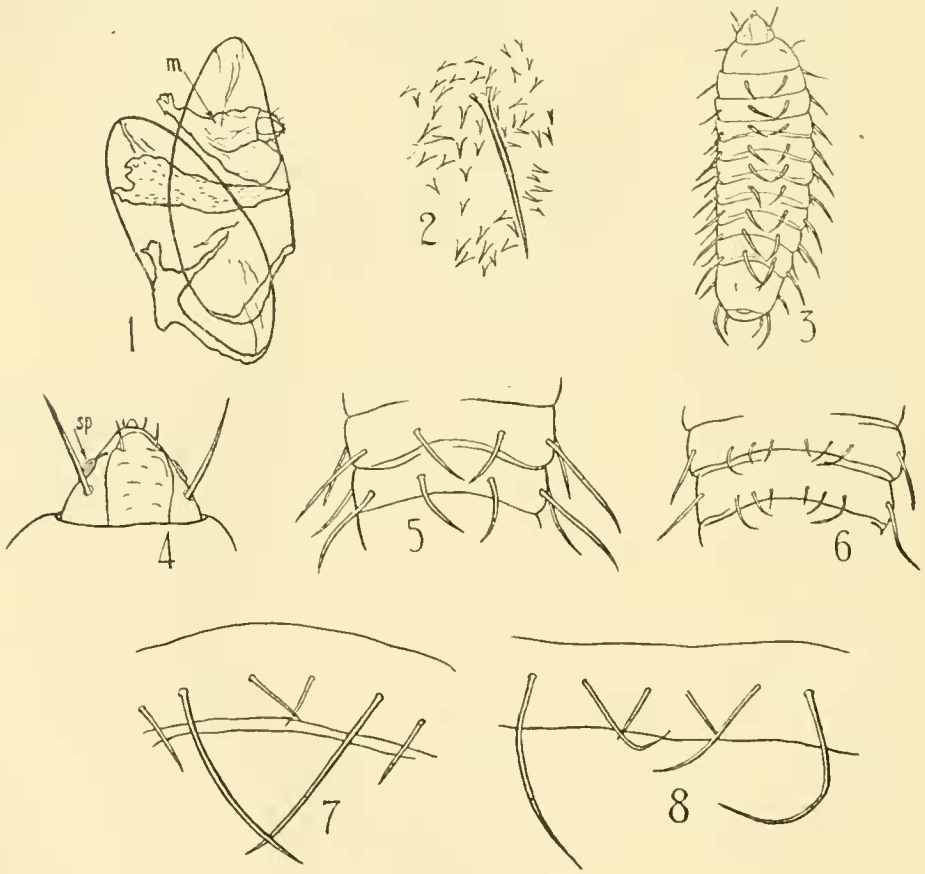
The quantity of soil in which it was possible to pick out the almost microscopic larvae, was obviously insufficient for the growth of grass for their nourishment. Accordingly, it was decided that the best chance of carrying out the chief aim of the experiment, the rearing of the larvae to maturity, was to place them in a large jar full of soil, containing a good growth of grass, and refrain from any further attempt to handle them until they had had time to increase greatly in size.

Unfortunately, this object was not attained. The jar containing the larvae was left undisturbed until the end of February, a period of three months; but when the soil was turned out, no trace of the larvae was found, under the most searching microscopical examination. Difficulty had been experienced in keeping the grass alive, and a constant degree of moisture in the soil, during the hottest summer weather, especially during a period when, through absence from Sydney, I was unable to attend to it myself. The larvae had evidently died under unfavourable conditions, or been lost during the removal of dead grass. Previous experiments in the rearing of larvae collected in the field had

shown that the younger the larvae, the more difficult they are to preserve alive. Adverse conditions which had no ill-effect on larvae over 6 mm. in length, invariably proved fatal to the smaller ones, and no larva under 5 mm. length, when collected, has, so far, been successfully brought through to the pupal stage.

Description of the newly-hatched larva.

Newly-hatched larvae measure from 0.8 to 0.96 mm. in length, and 0.27 mm. in lateral width. The chief structural differences from older larvae are found in



Metoponia rubriceps Macq.

Fig. 1. Empty egg cases, and moult skin (M). (x 48). Fig. 2. Portion of moult skin shown in Fig. 1. (x 475). Fig. 3. Newly hatched larva. (x 48). Fig. 4. Head of newly hatched larva. (x 175). Figs. 5-6. Dorsal view (5) and ventral view (6) of segments of newly hatched larva. (x 100). Figs. 7-8. Dorsal view (7) and ventral view (8) of segment of a larva 2 mm. long. (x 100).

the formation of the head, and in the arrangement of the bristles on the body. The eyes are quite rudimentary, and there is an entire absence of the lateral lobes which form such a prominent feature in larvae of larger growth (Fig. 4).

On the other hand, the head spiracles (?) are relatively much larger and more prominent (*sp.*). A small area of dark cuticle above each of them, indicates the position in which the lateral "boss" grows out later, evidently as a protective structure above the spiracle.

On the dorsal surface of each of the body segments there are instead of six, only two stout bristles. Tiny rudiments of the other bristles can be seen on some segments. The smallest larvae collected in the field, 2 mm. long, show these on all segments (Fig. 7), and the first bristles developed are found to be the middle one on each side. On the ventral surface, six bristles are present in the newly-hatched larva, but they are not equally developed and are very small and inconspicuous (Fig. 6). The outermost bristle on each side is the longest, and this is the case, still, at the 2 mm. stage (Fig. 8). It is, therefore, only with later growth that all the bristles of each surface become uniform in size. On the lateral ridges only the two larger bristles are present at first. These, at hatching, are about 0.12 mm. long, and give the larva a conspicuously hairy appearance.

The larva escapes from the egg through an irregular rupture extending up from the broad pole (Fig. 1). The first moult evidently occurs immediately after hatching, since many cast skins were found tangled up with the empty egg-cases (Fig. 1). These skins differ considerably from those of later moults. They are very soft, and delicate, do not retain the shape of the larva, and are not coated with calcareous hexagonal plates. In place of the plates are numerous delicate, finely-pointed processes (Fig. 2) scattered irregularly between the bristles. In larvae still contained in the egg, the armoured coat can be seen, already developed, beneath this skin. The structure of the head can be made out more easily in the moult skin than in the unhatched larva. Both show an earlier stage of development than the hatched larva, which is especially interesting in the case of the mouth-parts. These will be considered later, in conjunction with a detailed study of the fully-developed larval mouth-parts. The structures which have the appearance of spiracles are very conspicuous, and each is seen to connect, internally, with a small tube, which can be traced for a short distance into the head.